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Chief, []

27 July 1955

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Chief, []

Engineering/Operations
Infrared Communications System

1. Herewith are some preliminary comments pertaining to the operation of the subject Infrared Communications System, pending the availability of an approved operation and maintenance manual. [] will provide operational checkout and answer any queries you may have.

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A. General - The IR Communications System is a line of sight device; and physical alignment of the transceivers must be accomplished in accordance with a pre-arranged plan.

(1) The maximum range and quality of reception with respect to signal strength is a function of the prevailing atmospheric conditions over the transmission path. A transmitted infrared beam is attenuated by absorption due to the presence of moisture in the atmosphere. The degree of absorption is a function of the radiation frequency and the natural wavelength of the moisture particles. When the wavelengths are equal, the absorption rate is high; and when the wavelengths are widely separated, the absorption is minimum; thus it is possible to transmit through a heavy fog which obscures the target receiver from view, although penetration of a light rain storm with the receiver in view may not be possible.

(2) The maximum range and quality of reception with respect to signal-to-noise ratio is a function of the degree of random infrared radiation existing over the transmission path. Due to the presence of random infrared radiation close to

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the Earth's surface during the daylight hours, a lower signal-to-noise ratio will exist during the day than during the hours of darkness. Additionally, all warm bodies give off infrared radiation. When the wavelength of such radiations falls within the sensitivity of the infrared detector (.7 to 3 microns), they contribute to the noise level. Thus a transmission path over tin roofs, concrete runways, and the like that have been warmed by the sun's rays should be avoided when possible.

- B. **Alignment** - A signal plan for physical alignment of the transceivers for initial communication contact can best be written around the operational requirement. To facilitate alignment, both transceivers are provided with a 1 kc/s tone; in addition, the base station is equipped with an infrared viewer that is aligned with the optical system. It has been found that binoculars and compasses assist greatly in establishing contact. In general, if a reasonably good knowledge of the transceiver locations has been established (within a few degrees) no difficulty should be encountered. The infrared viewer has limited use for daylight alignment and is useful up to nine miles during hours of darkness. (The maximum night time operating range exceeds the viewer range.) An initial alignment contact with binoculars and compasses was made during daylight over a distance of 13 miles, and the quality of reception at this distance was considered adequate. After an initial contact has been established, both stations should make critical horizontal and vertical adjustments for maximum signal strength. When communications contact is established, the alignment particulars of both stations should be noted for any desired future operation from the same locations.
- C. **Battery Charging** - A link is provided in the set to permit charging the batteries from either a 110 or 220 volt source. The equipment as shipped has the link in the 220 volt position. The AC mains charging cable is located inside the front cover. To charge the batteries, depress the red button on the operating panel and hold (about ten seconds) until the dual purpose modulation indicator glows continuously. The indicator goes off automatically when the cells are fully charged.

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- D. Source - The Infrared source is a thirty watt tungsten filament having a nominal 30-hour operating life. Spare lamps will be supplied. The optical system provides a transmitting beam of 1 1/4 degree vertical X 1/4 degree horizontal.
- E. Detector - The detector is lead sulfide, having an area of 1 square millimeter. It is relatively insensitive to the visual spectrum, thus rendering daylight operation feasible. The receiving beamwidth is 1/3 degree X 1/3 degree.
- F. Bellows - Unless the bellows are properly secured in the open position, the optical system will be out of alignment. Proper positioning is accomplished by opening the bellows to full open, at which point the slide pins on the scissor arms are indexed. To close the bellows, apply finger pressure to the spring loaded slide pins simultaneously.

2. Inasmuch as this new equipment has high potentialities for KUEARK use, both KURIOT and KUCLUE request detailed comment on the operational results experienced with the equipment. It is important that we be advised by cable should the equipment become compromised.

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